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Drainage Water Management

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USDA Agricultural Outlook Forum
February 22, 2013

Photo: Dan Jaynes 

Our drainage infrastructure

Subsurface “tile” drainage



Surface drainage



Drainage is required to provide aeration
to crops



Photo: R.W. Skaggs 📷

Drainage is required to provide trafficable conditions for field operations



Photo: R.W. Skaggs 

Once drained, wet soils are among the most productive in the world



The drainage infrastructure is extensive, underlying much of the agricultural land in the Midwest.

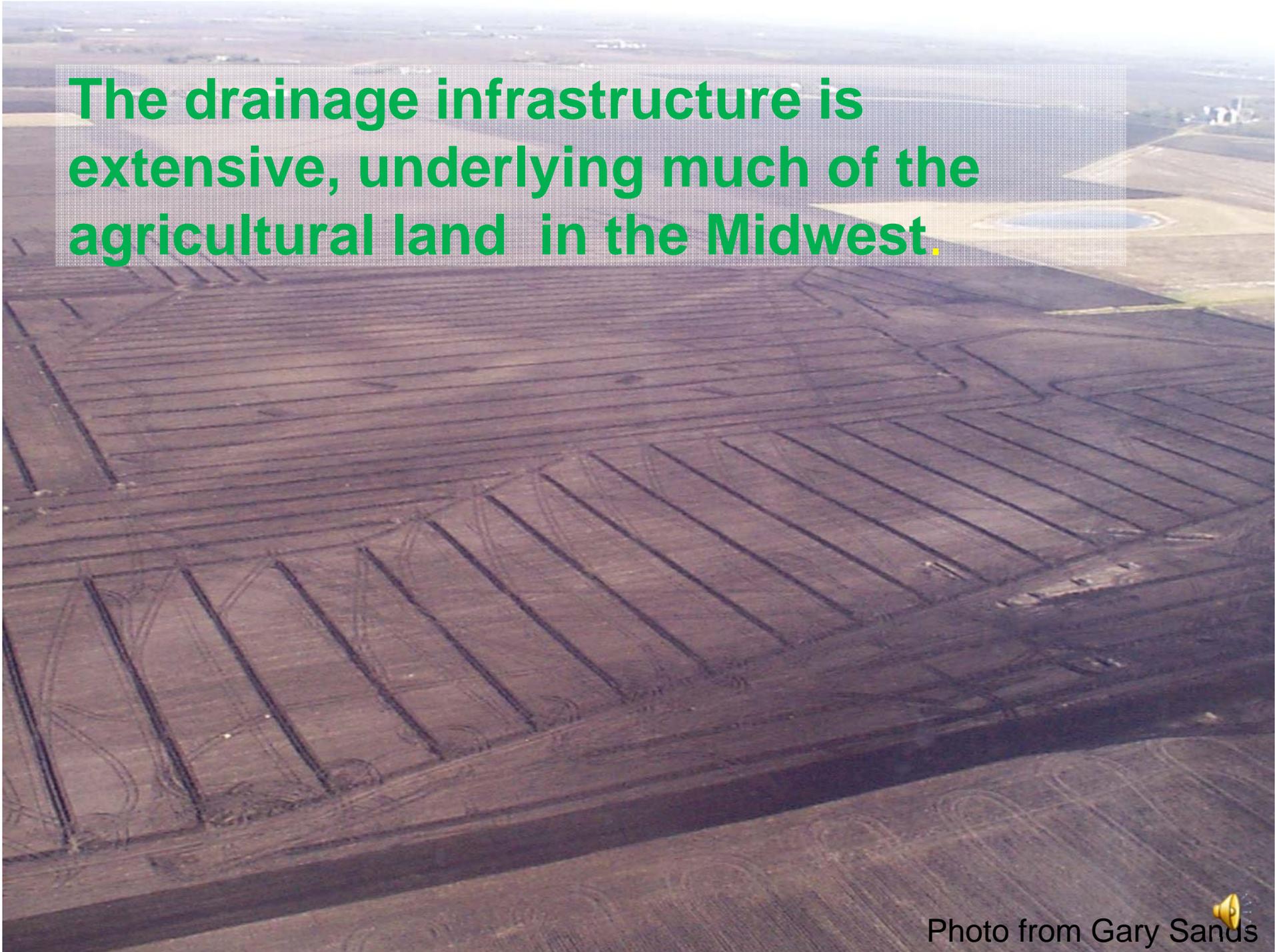


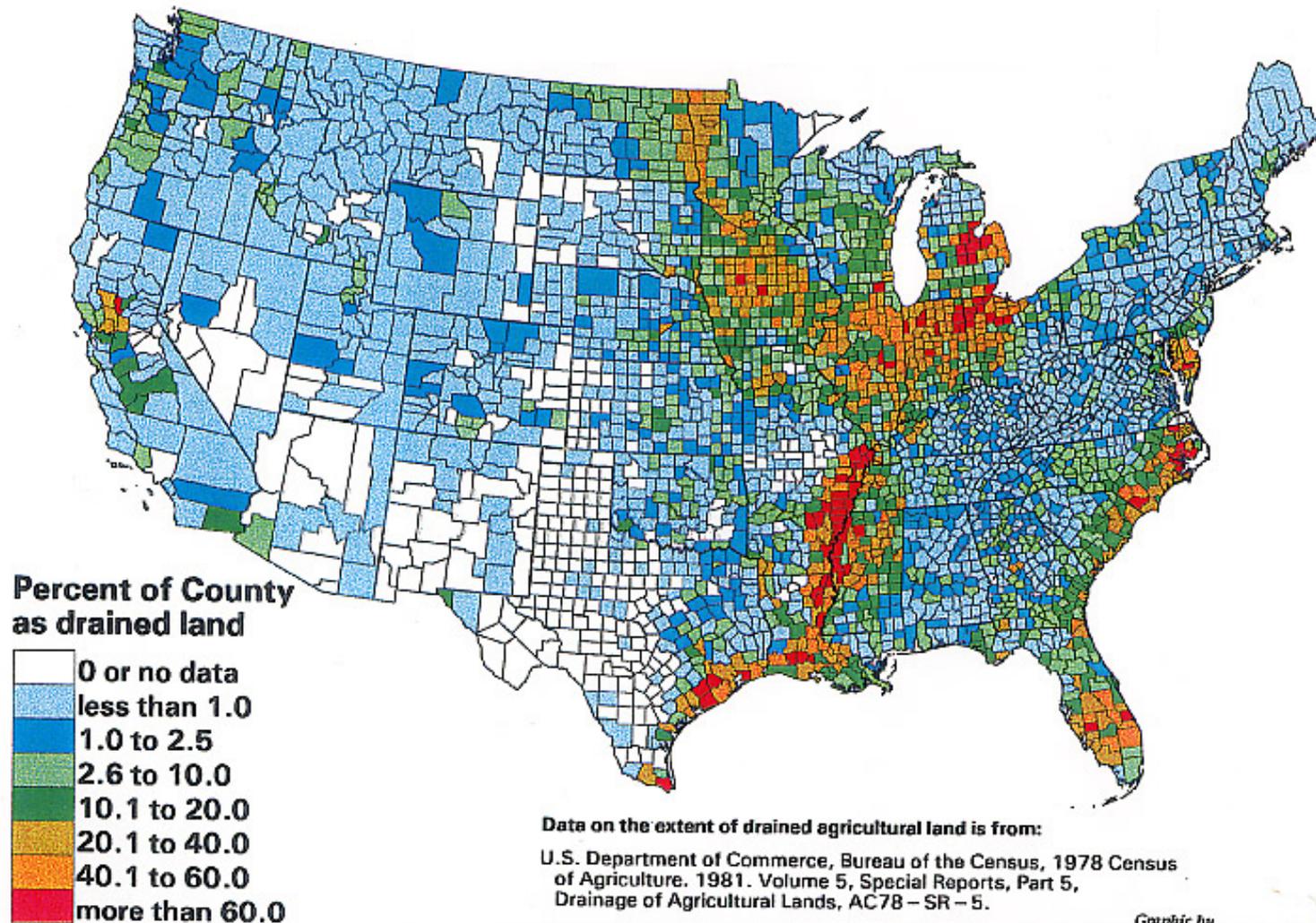
Photo from Gary Sands 

Drainage is still being installed, and at rates higher than ever in recent years

- Yield monitors on combines make the effects of drainage more easily recognizable
- High crop prices makes additional drainage pay



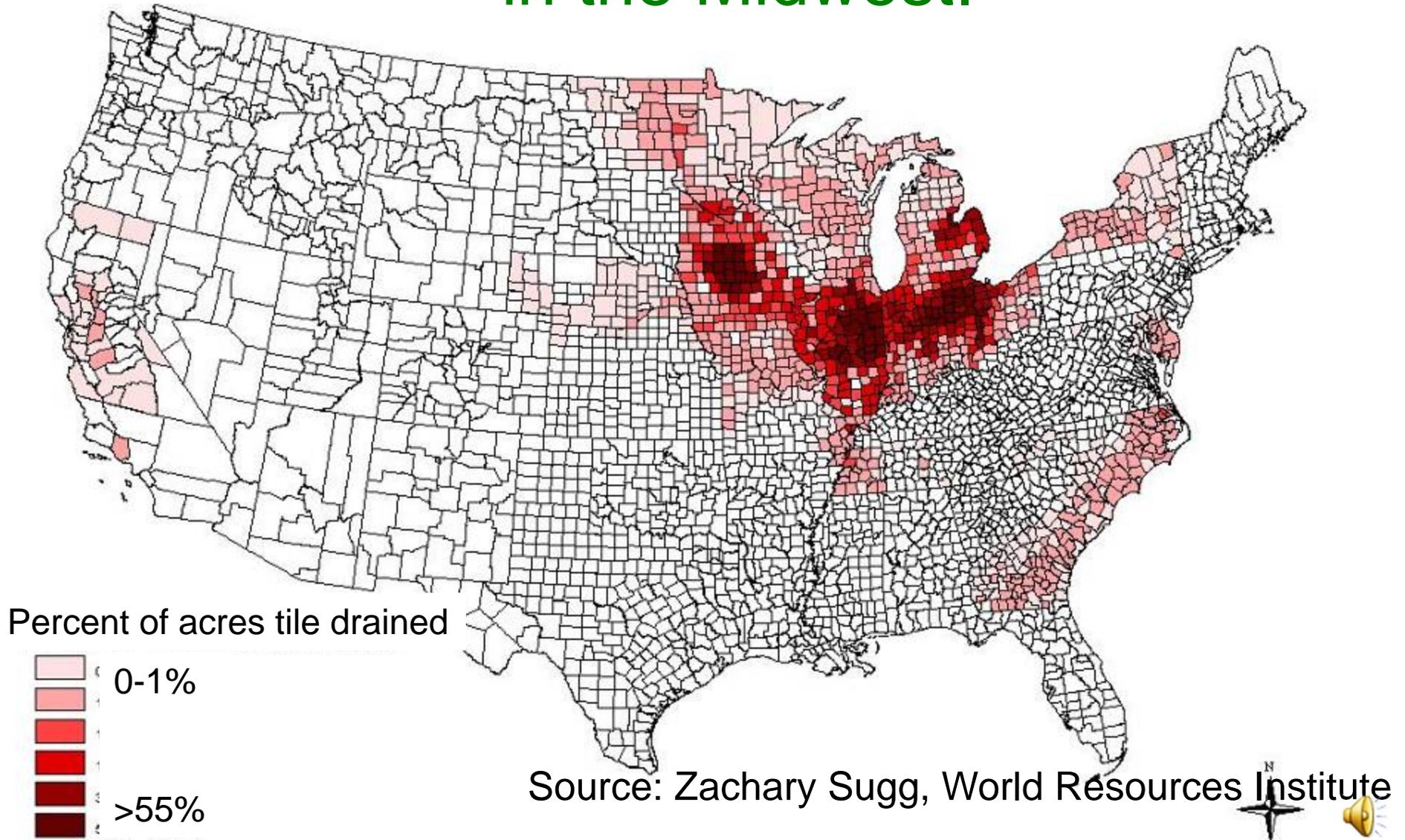
Drainage is concentrated in central and eastern U.S.



Graphic by
William Battaglin, USGS



Subsurface “tile” drainage is concentrated in the Midwest.



Intended effects of tile drainage

- Increased yields
- Decreased surface runoff, soil erosion, and loss of nutrients through overland flow and erosion



Photo from Dan Jaynes 

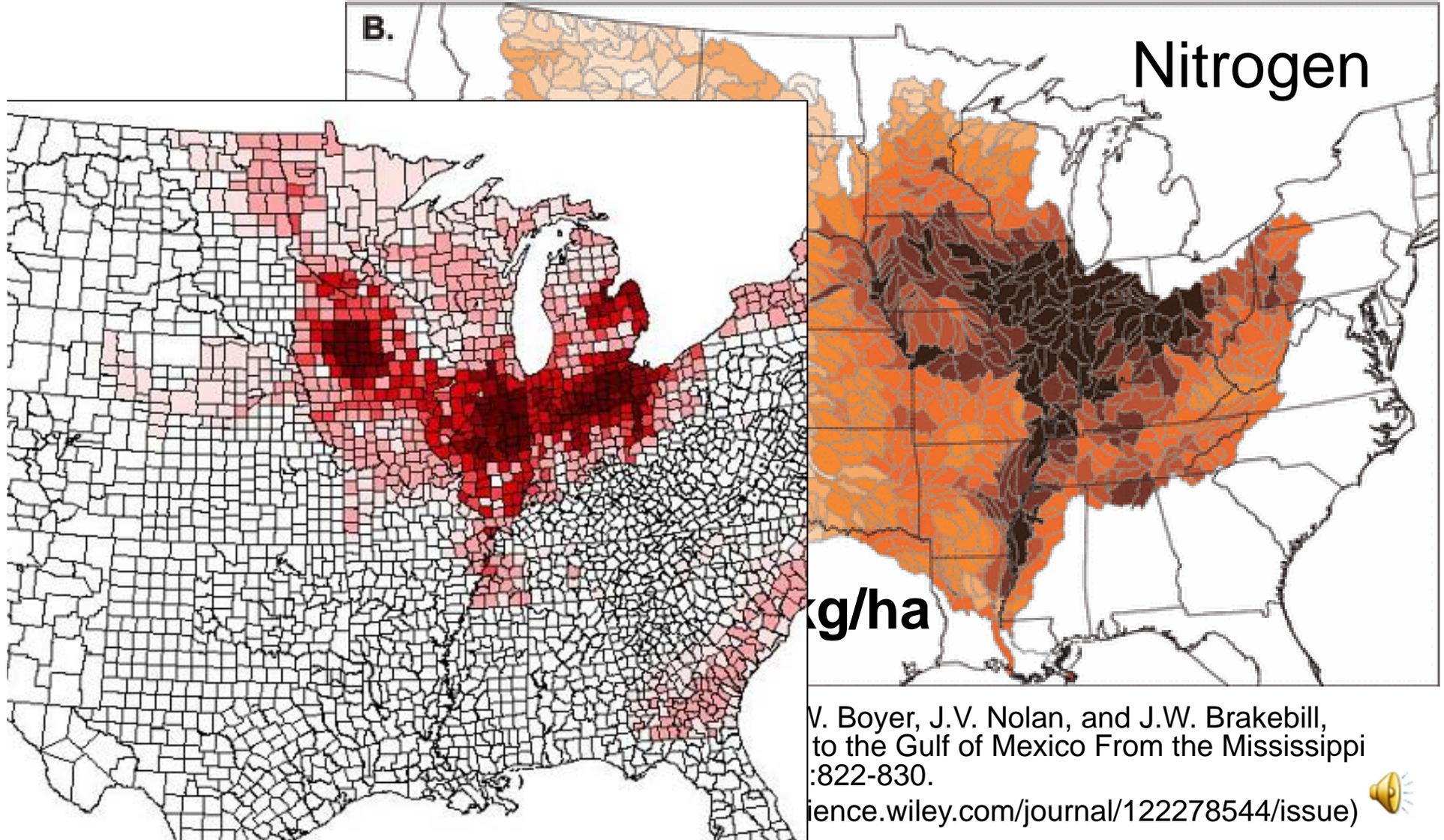
Unintended effects of tile drainage

- Greatly increases loss of **nitrate** to streams



Photo from Dan Jaynes 

Nitrogen delivered to the Gulf of Mexico, by watershed



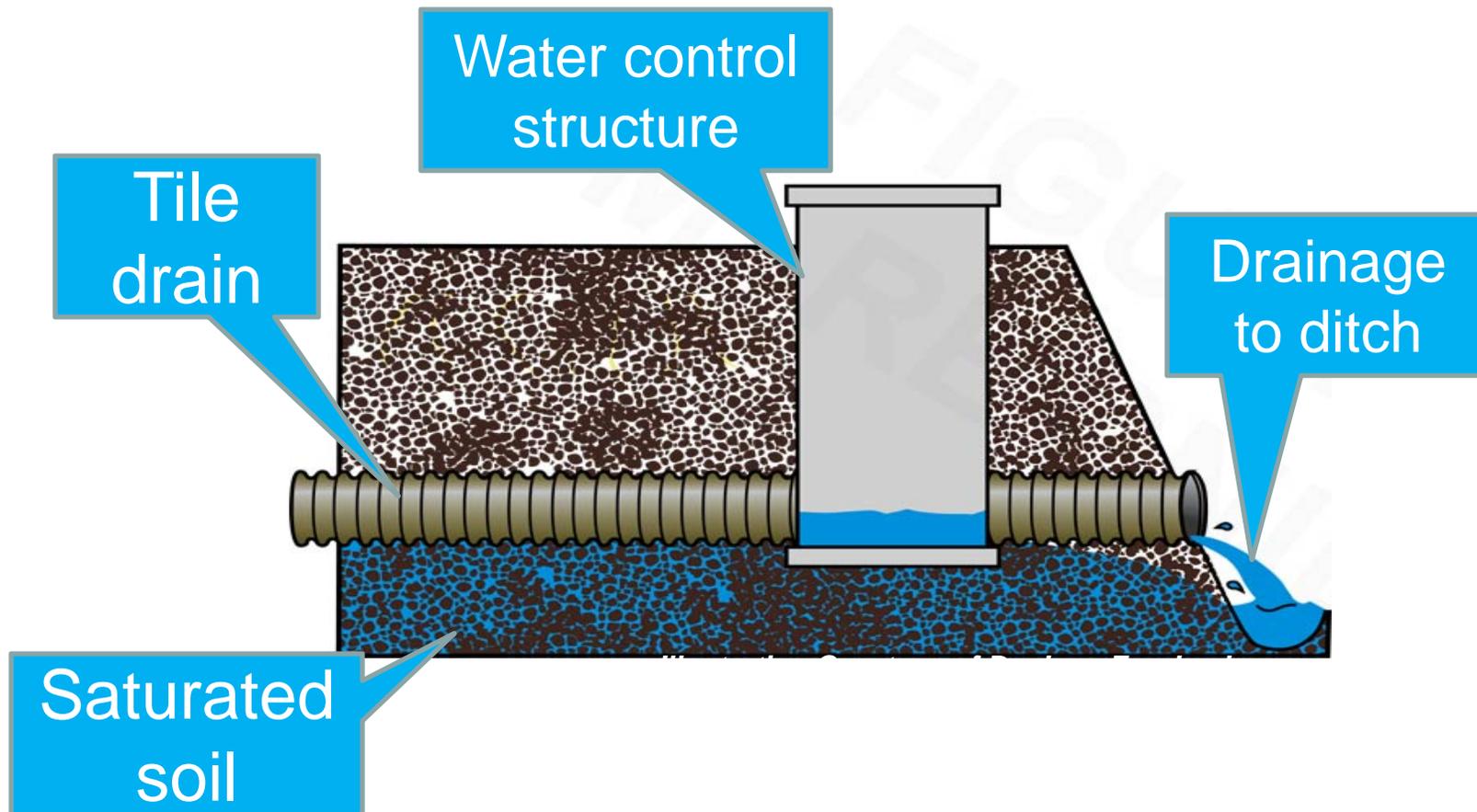
Drainage Water Management

- The concept is to drain **only what is needed** for crop production
- Drainage needed is not the same throughout the year.
 - **In winter**, drainage is not needed.
 - **In spring**, maximum drainage is needed to get into the field
 - Holding back water in **the summer** can help the crop



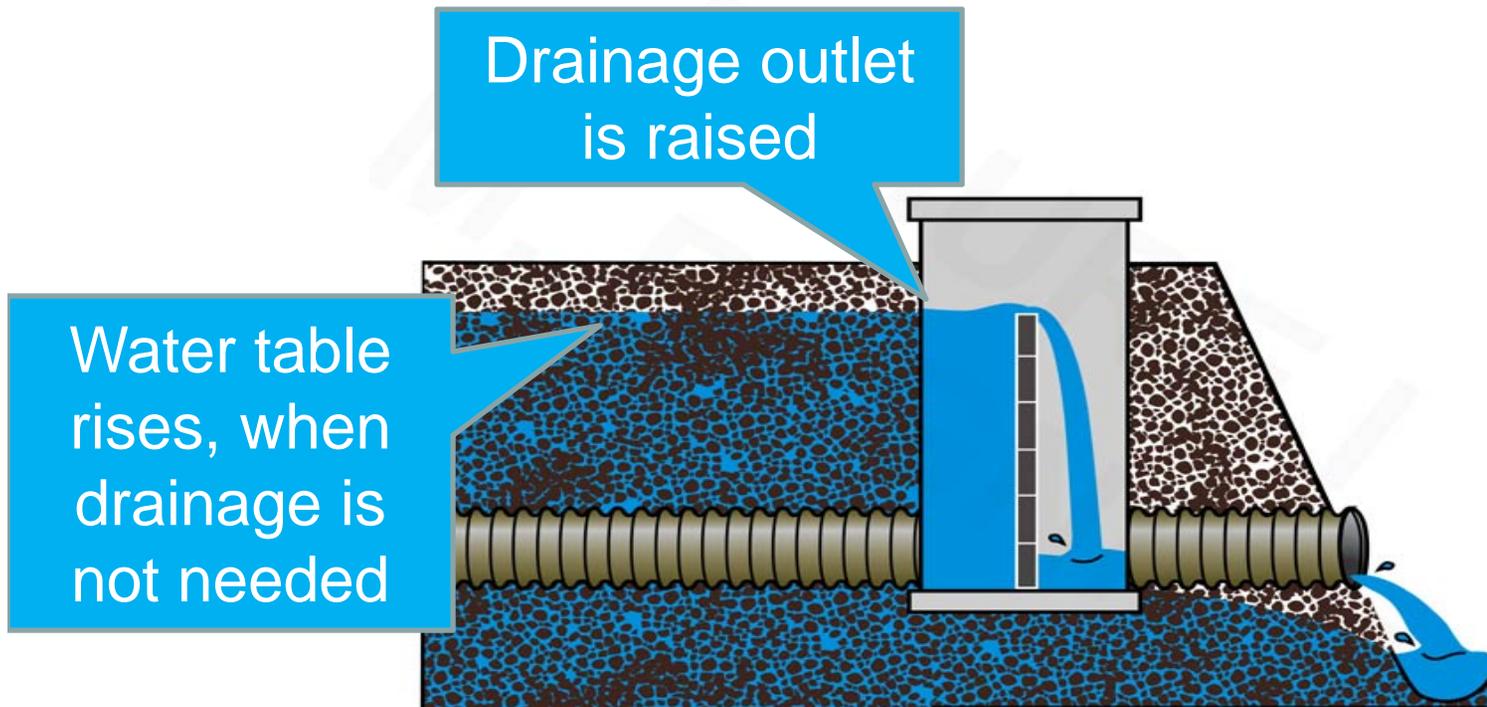
Drainage Water Management

Conventional Drainage Mode



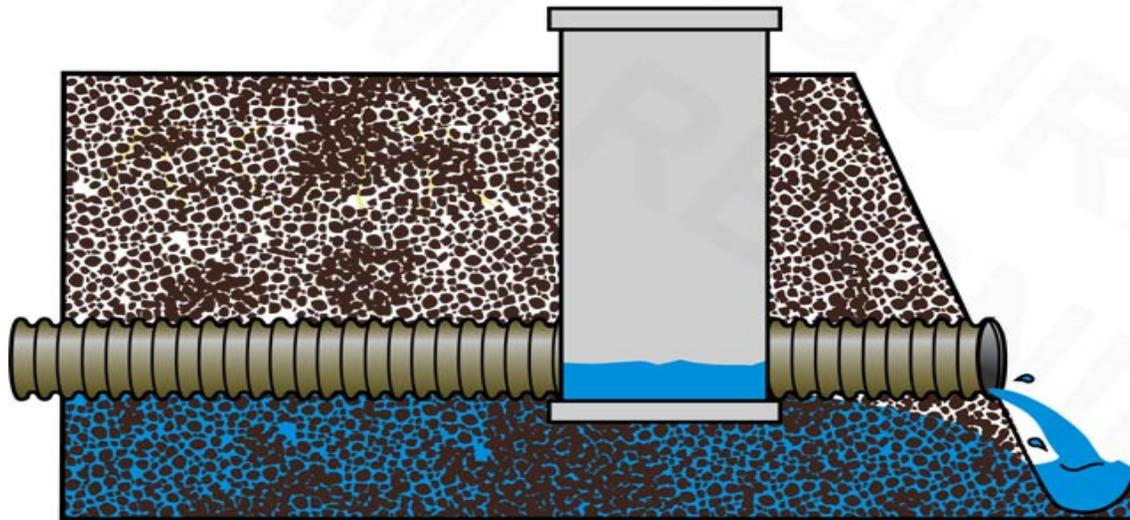
Drainage Water Management

Winter Conservation Mode



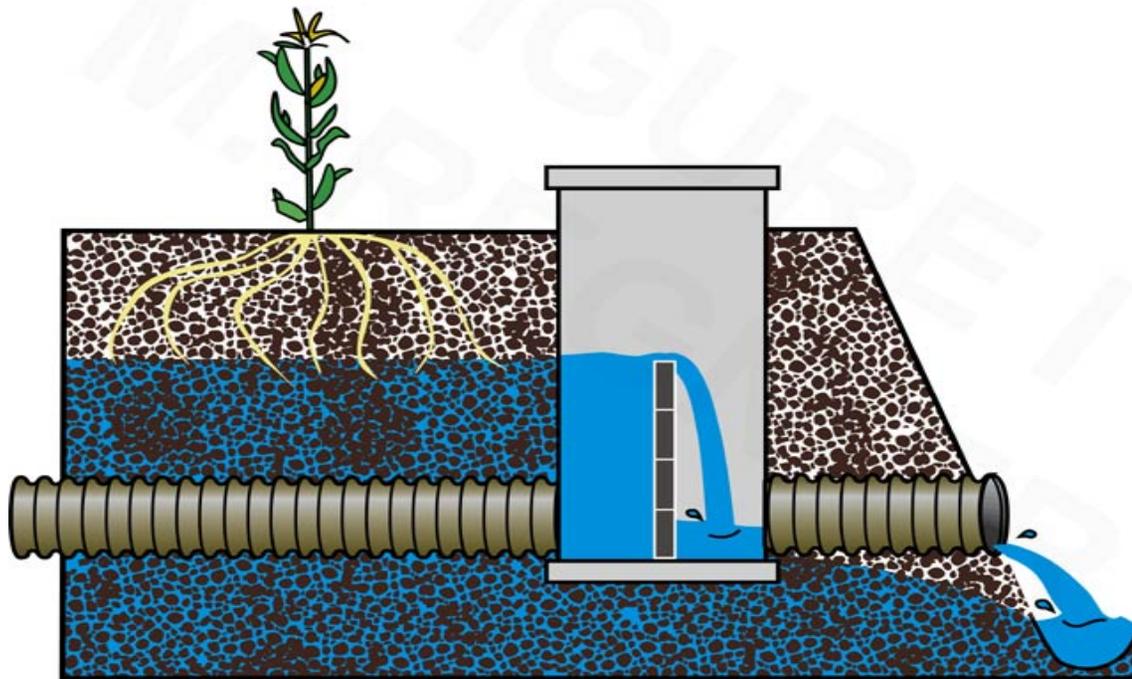
Drainage Water Management

Lowered before planting



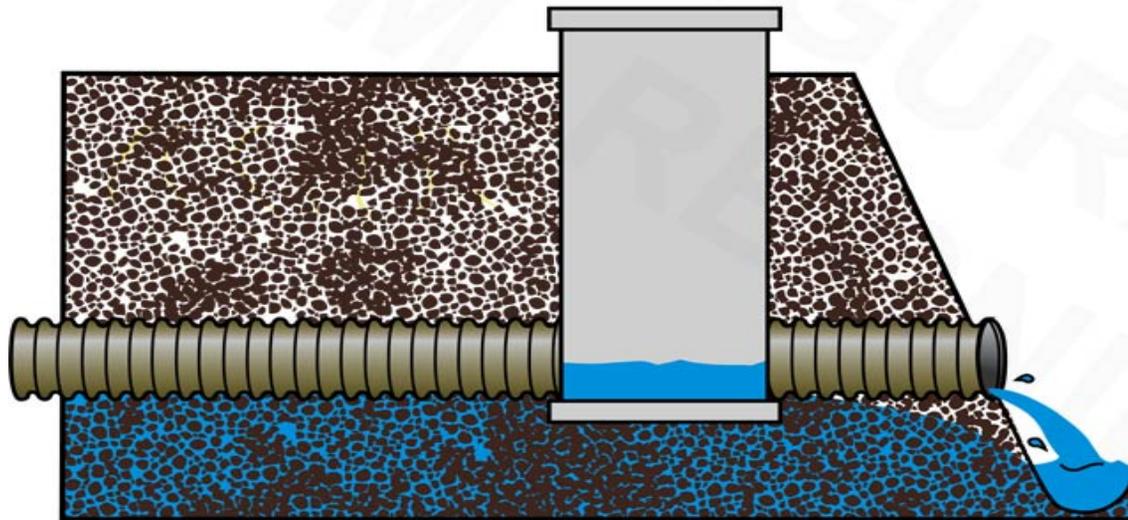
Drainage Water Management

Summer Conservation Mode



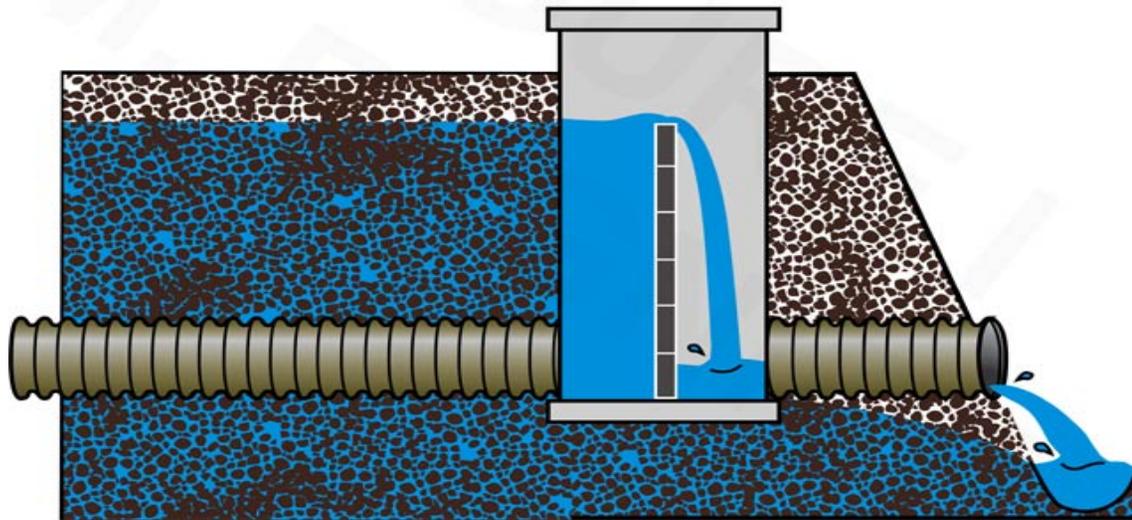
Drainage Water Management

Lowered before harvest



Drainage Water Management

Winter Conservation Mode



First used for water quality benefits in North Carolina about 40 years ago



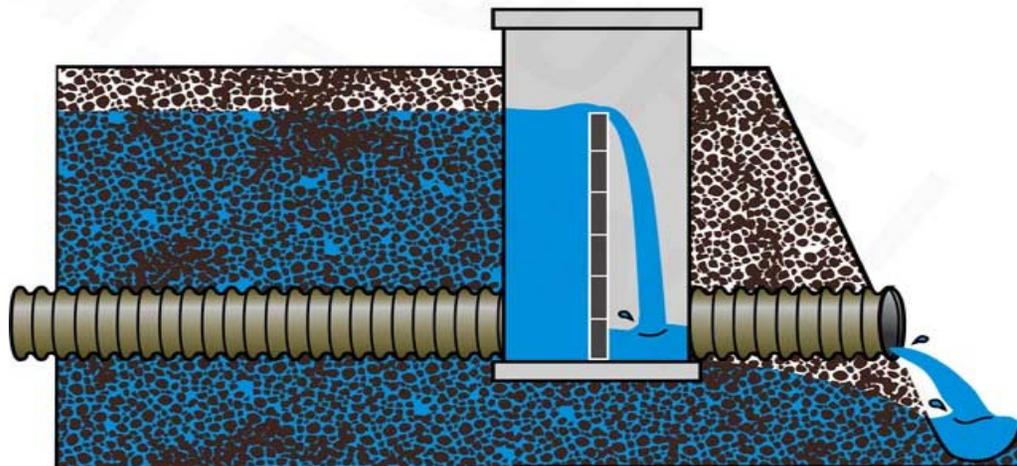
Promoted in the Midwest for about a decade

- Control structures placed in main drain lines.
- Automated structures have also been developed.



Drainage Water Management

- *Frankenberger*: Implementation activities and barriers
- *Skaggs*: Development of the practice; published work on yields and nitrogen reductions
- *Hicks*: A farmer's perspective



Needed for implementation

- Solid research base
- Efficient technology
- Education of producers, who make the decisions
- Education of contractors, who design and install systems as Technical Service Providers
- Education of agency staff, to manage the programs efficiently
- Effective incentives (financial and/or other)

Research has been and is addressing key questions

- How much yield benefit can we expect?
- How much nitrate reduction?
- Could drainage water management have a negative effect on soil health?
 - Earthworms
 - Soil bulk density (compaction)

Multi-state project to assess potential for drainage water management

- USDA-NRCS Conservation Innovation Grant
- 4 sites in each of 5 states (Minnesota, Iowa, Illinois, Indiana, Ohio)
- Industry managed (Agricultural Drainage Management Coalition)



Field-scale research in each state



Does drainage water management affect soil health?

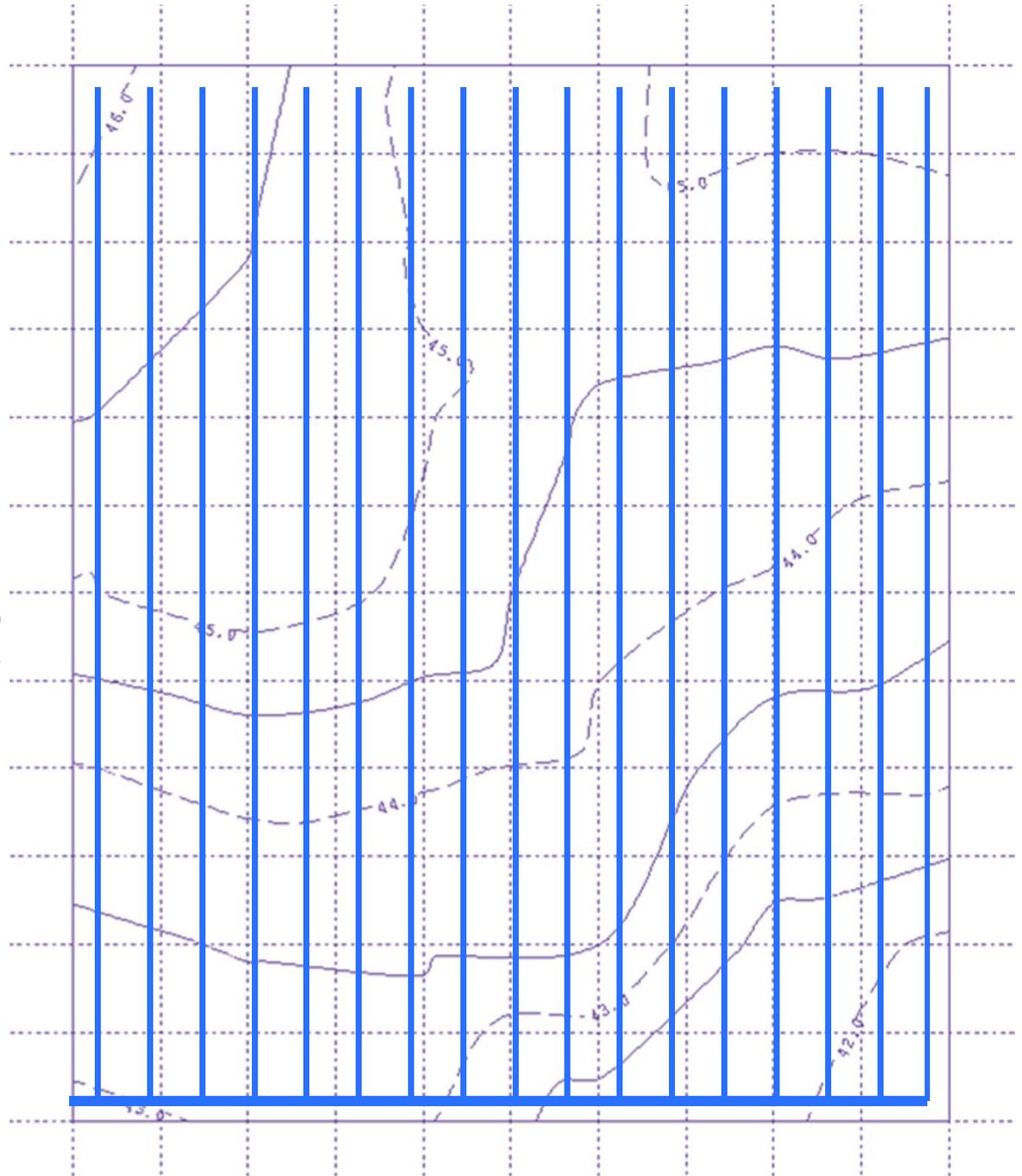
- Effect would likely be negative
- Did not significantly reduce earthworm populations
- Did not significantly increase bulk density or penetration resistance



Efficient engineering design and technology for installation

- Most effective if drainage is installed on the contour

Designing a drainage system for drainage water management



Designing a drainage system for drainage water management

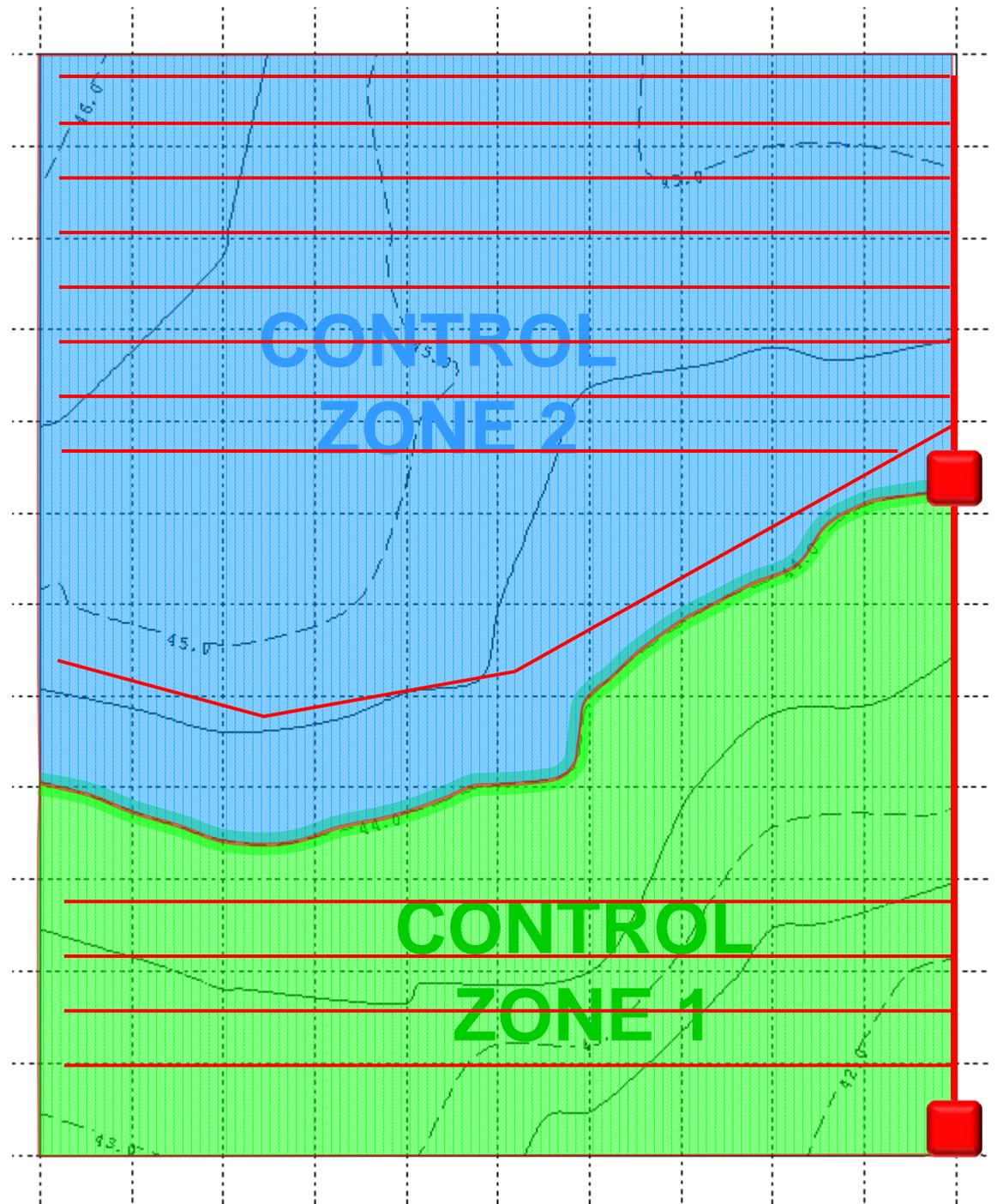




Photo: Gary Sands

Education of producers who make decisions



Education of contractors, who design and install systems

- Agricultural Drainage Water Management Coalition has trained approximately 100 Technical Service Providers
- Goal is 600, or approximately 60 per state.

Education of agency staff, to manage the programs efficiently

- NRCS has created the Ag Water Management Team, who coordinates program implementation, technical aspects, and training
 - Led by Paul Sweeney
 - Approximately 30 other people
 - Advisors from outside the agency

Effective incentives

- The USDA NRCS may provide payment for the following practices:
 - 554 Drainage Water Management
 - 587 Structure for Water Control.
- *For example, in Indiana EQIP payments were up to \$40/acre/year in Indiana, but end after 3 years.*



Despite all these activities, adoption is low, especially compared to the amount of drained land

- Drainage is invisible. Nitrate is completely invisible.
- The current, “conventional” drainage system is working remarkably well **for producers.**
- People downstream are asking the agricultural community to do more. Perhaps financial incentives alone are not enough.

More intensive drainage calls for more intensive effort to reduce nitrate loss.

The problem is clear

A technology exists to address it.

Will we accept the challenge to do more?

